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— Warren Samuelson, manager of the TCEQ's Dam Safety Section

In May of 2015, an East Texas dam failed after enduring abnormally heavy rainfall all spring. Thankfully, no lives were lost.

HOLDING BACK DISASTER

TCEQ'S DAM SAFETY ENGINEERS WORK TO SAVE LIVES

The history of this state is full of stories that attest to the enormous power of water, which can give and take life, sometimes in the blink of an eye. Consider the rough lives of long-ago Texans who endured the hardships that often have an impact on the state: the heat, the droughts, and the floods.

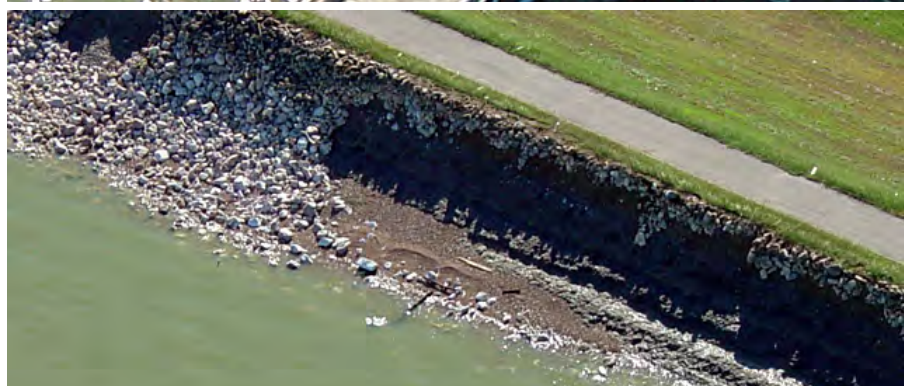
Only then can you appreciate the miracle of dams. This human tool lessens the effect of floods, and it can hold back and store the water that enables life to blossom here. The very well-being and quality of life of Texans depend on dams.

Yet, despite all the planning, expertise, and expense that go into building dams, sometimes emergencies happen. Whether because they were not properly maintained or because of a cataclysmic weather event, dams can be damaged or even fail.

That is precisely why the 25 engineers employed by the Texas Commission on Environmental Quality's Dam Safety Program, which is responsible for the regulation of nearly 4,000 dams in the state, are so important. When extreme weather strikes Texas, and its dams become stressed, emergency responders turn to the TCEQ's dam safety engineers to help avert disasters.

"Our biggest concern is for public safety," says Warren Samuelson, manager of the TCEQ's Dam Safety Section

In 2005, Lake Livingston Dam (as seen here and below) made it through Hurricane Rita but not without incurring some damage, especially to the upstream slope. It was not worse, though, thanks to the work of its operators following the emergency action plan and because the hurricane did not produce as much water as it could have. Located due north of Houston, the lake is the second largest in Texas, with a capacity of 1,785,348 acre-feet.



and a nationally recognized expert on dams. “Our focus is on dams with the highest risk.”

Risk levels for dams are determined by the number of people living downstream. Low means no one downstream. Significant means fewer than seven, and high is more than that.

When Storms Strike

Whenever extreme rain events befall the state, engineers from Samuelson’s section stand ready to help.

Samuelson says that the TCEQ works closely with both emergency-management coordinators in Texas counties and with the State Operations Center, located at the Texas Department of Public Safety’s headquarters in Austin, counting on them to let the dam safety engineers know when assistance is needed.

Hurricane Rita

In 2005, when Hurricane Rita struck the state, sensational media stories gave dire reports about the integrity of the dam holding back the very large Lake Livingston, north of Houston. The National Guard at the State Operations Center quickly transported Samuelson to the dam, which had been pounded by 117 mph winds but not a tremendous amount of rain.

Samuelson says the dam was damaged, but it functioned exactly as it was supposed to, despite 15-foot waves going over the top.

“I think you could have surfed down there,” he says.

Most of the damage was to a two-mile stretch of the upstream slope. Dam operators followed the emergency action plan, which identified what to do to keep the dam safe in the case of an emergency. Such plans also identify areas that might need to be evacuated if a dam’s integrity is threatened.

“The Trinity River Authority was doing what they needed to do to get the



TCEQ engineer Levi Best (shown above and right) examines Mosher Big Lake Dam following an intense storm that struck Bandera County in late May and early June. Best and Johnny Cosgrove, another TCEQ engineer, provided advice to the dam’s owners and Bandera County on how to best resolve the situation.

lake levels down,” Samuelson says; however, “They were fortunate the hurricane moved out.”

The Bandera County Storms

A recent spate of storms provides yet another example of the dam safety engineers’ emergency response efforts. In late May and early June of this year, intense storms ravaged Bandera County, in the hill country, straining normally sound flood-protection infrastructure. According to various media reports, many homes in the county were inundated by flash floods, and some cars and trailers were swept away.

During the storms, which began on May 29, the TCEQ received requests for assistance from Bandera County concerning the damage and strain on Mosher Big Lake Dam. Responding to these requests, TCEQ engineers Johnny Cosgrove and Levi Best inspected the damaged dam, which normally impounds 342 acre-feet



of water, and advised that the county or owners bring in pumps to lower the swollen lake immediately, and, if that was not enough, to cut a relief channel.

“It is speculated that another significant overtopping event ... could possibly result in failure,” Cosgrove stated in his report on the dam, which was built in the 1950s. “It appeared that the dam was overtopped by roughly six inches of flood waters, predominantly in two localized

low areas along the crest of the dam. Multiple vertical scarps [damaged areas] were eroded on the downstream slope at the two low areas, with some scarps measuring over seven feet in height but with pockets of erosion spanning the full height of the dam.”

Cory Van Telt, a San Antonio-area meteorologist for the National Weather Service, says the Hill Country terrain in Bandera County contributes to flooding issues. He says rain runs off the limestone hills and into the canyons and creeks, creating a great potential for flash flooding.

The National Weather Service’s rain gauge in Medina showed 11.19 inches total in May and 6.41 inches during the storms that raged from May 29 through June 5.

“Considering there was so much rain earlier in May, the ground was already saturated,” Van Telt says. “Getting that amount of rain after such a period can cause flooding.”

He says the National Weather Service does not have many monitoring sites in Bandera County and that rainfall totals could have been much more intense in localized areas. While Van Telt states that the Medina gauge got 2.4 inches of rain on May 29, other parts of the county got as much as 10 inches on that day, according to various media reports, including CNN.

Carey Reed, Bandera County’s emergency-management coordinator, is appreciative of the assistance she received from the TCEQ’s dam safety engineers, who arrived at Mosher Big Lake Dam within 24 hours.

“We were really concerned about the dam,” Reed says, adding that the engineers put her mind at ease about what the county needed to do.

Besides technical advice to help retain the structural integrity of the dam, the TCEQ engineers helped the county create an emergency action plan, which included identifying more than three dozen homes



This is the result of a dam being overtopped and partially breached. Just one-third of the dams that fail do so because they are overtopped. Internal seepage counts for another third, and assorted causes for the other third.

that would need to be evacuated if the dam was about to fail.

Had it kept on raining, the dam may have been at risk, and evacuations of homes may have been necessary, Reed says. Nevertheless, thanks to the TCEQ engineers, she had what she needed to help keep county residents safe if the weather had not cooperated.

“I don’t know anything about dams,” Reed says. “Having someone being able to come out puts our mind at rest. I couldn’t have done that without them.”

In the past years, the stability of the 100-plus-year-old Medina Lake Dam, which normally holds about 250,000 acre-feet of water, had concerned residents. During the latest storm, Bandera County officials received calls from concerned residents, and the TCEQ responded to media requests regarding the dam.

However, the TCEQ, which worked closely with the Bexar-Medina-Atascosa Water Improvement District to improve the dam’s safety, considers the dam to be quite stable. Modifications to the dam to withstand high lake levels were completed in 2012. These modifications, which were

approved by the TCEQ, included anchoring the dam to allow water to go over the top without damaging it.

So when the lake, which stood at 5 percent of capacity in early 2015 and less than 65 percent in April of this year—according to data from the Texas Water Development Board—dramatically filled up in that May-June storm, the dam performed admirably, with flood water diverting over its spillway.

Samuelson says that one-third of the dams that fail do so because they were overtopped, one-third because of internal seepage, and one-third for other causes.

Preventing Disasters

It is important that the state remain vigilant with its dams, Samuelson says.

“There are a lot of folks moving into Texas,” says the 45-year veteran of the TCEQ. “There is not a lot of room for them to go. A lot of people are moving downstream of dams.”

Dams under the TCEQ’s authority are normally inspected when they are constructed and every five years after that. TCEQ engineers also review

engineering plans and make sure that significant- and high-hazard dams have emergency action plans.

Even beyond directly applying their technical expertise, TCEQ engineers try to improve the quality of the state's dams preemptively, by helping to educate owners and operators. Since 2007, the state has conducted 36 workshops on dams, with more than 2,800 participants.

At these workshops, TCEQ engineers talk about laws and regulations, case histories of dam failures, owner responsibilities and liabilities, security issues, dam operations, maintenance and inspections, and emergency action plans.

The workshops help "mitigate the things that could happen," Samuelson says. "The biggest thing I have seen with the workshops is a lot of sharing, networking."

The workshops help connect those responsible for dams with TCEQ engineers.

The ultimate message that the TCEQ is trying to communicate during

its various educational workshops is that "It will be most cost effective if you fix problems when you find them," says Samuelson.

We always need to appreciate the sheer power of water, he says, which can easily lift large boulders and cars.

"It has a tremendous amount of force. I have seen dams that were there, and in thirty minutes, the dam was gone." 🐼

Dam Safety Workshops

The TCEQ's Dam Safety Program occasionally offers workshops to help educate dam owners and operators about best practices and their responsibilities. Find out more about these workshops at <www.tceq.texas.gov/p2/events/dam-safety.html>.



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